

DRAFT --- March 2006

Appendix G

**Description, Features and Assumptions
used in 2000 Base, 2050 Base, CERP1,
and NSM Model Runs**

Summary Table

**Effects of Future CERP Scenarios on
Salinity Conditions at the Taylor River Site and
Northeastern Florida Bay**

Description, Features and Assumptions used in 2000 Base, 2050 Base, CERP1, and NSM Model Runs

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Model Run Name : 2000B1

Description :

The 2000B1 Existing condition represents conditions that existed in South Florida in 2000, when CERP was approved. In general, assumptions in the 2000B1 represent structures, operations, system demands and land use that were in place in the year 2000. Where emergency operations were in place at that time, operations more representative of "normal" operations have been used in the 2000 existing condition for long-term simulation. The 2000 existing condition is a planning base, and since planning by nature is iterative the simulation is labeled 2000B1, with the expectation that it will be updated as assumptions change over time through the review process.

The Initial CERP Update is being undertaken by an interagency, interdisciplinary team of the RECOVER program in CERP. The purpose of the update is to incorporate new information gained since the C&SF Comprehensive Review Study was released (July 1999). The scope of this effort is to:

- update planning conditions from the 1995 data used in the Restudy to 2000 data, such as land use, population, and water use
- update structural, operational and regulation schedule changes to the water management system
- update forecasts of 2050 conditions based on new data since the Restudy
- evaluate the performance of the Comprehensive Plan using the latest updated versions of the South Florida Water Management Model (SFWMM) and the Natural System Model (NSM)
- document all findings in a technical report

Planning for water resources purposes in South Florida relies strongly upon a computer simulation tool called the South Florida Water Management Model, which is capable of simulating the daily hydrology and operations of the water management system. The model requires input data, termed "assumptions", that govern the results, or outputs, of a given model simulation. Use of this modeling tool allows informed discussion as to what assumptions appear reasonable as input data. In addition to the use of new data, the SFWMM and NSM have undergone updating and improvements to increase accuracy of predictions.

The first updated model run for the 2000 Existing Condition will be posted on the web at http://modeling.cerpzone.org/cerp_recover/pmviewer/pmviewer.jsp for agency and public review. In the planning process, conditions that exist at the time of the investigation, or study, are collectively called the "existing condition." The existing condition is a reasonable depiction of current, relevant circumstances in the planning area.

Descriptions, Features and Assumptions of Model Runs

Planning by its nature is iterative. This web posting begins the review and discussion of the assumptions for the 2000 Existing Condition. These assumptions may change over time, as the review process proceeds. Additionally, as external review of the calibration/verification of the SFWMM goes forward, there is the potential that the outputs (results) of the model may be refined as well.

The assumptions for the 2000 Existing Condition as currently modeled for the Initial CERP Update are to be used for planning purposes only and are presented in the table below.

The assumptions for the proposed 2000 Existing Condition should not be construed as those that will necessarily be contained within the “Pre-CERP Baseline” as called for in the draft Programmatic Regulations (August 2002). The definition of the assumptions to be used in the Pre-CERP Baseline will be coordinated through an interagency process as required by sub-part 385.35 of the draft Programmatic Regulations.

Feature Assumptions

Regional Input Data

Climate

- The climatic period of record is from 1965 to 2000.
- Rainfall estimates have been revised and updated for 1965-2000.
- Revised evapotranspiration methods have been used for 1965-2000.

Topography

Updated November 2001 and September 2003 using latest available information (in NGVD 29 datum). Nov 2001 update (Documented in November 2001 SFWMD memorandum from M. Hinton to K. Tarboton) includes:

- USGS High Accuracy Elevation data from helicopter surveys collected 1999-2000 for Everglades National Park and Water Conservation Area (WCA) 3 south of Alligator Alley
- USGS Lidar data (May 1999) for WCA-3A north of Alligator Alley
- Lindahl, Browning, Ferrari & Helstrom 1999 survey for Rotenberger Wildlife Management Area.
- Stormwater Treatment Area surveys from 1990s
- Aerometric Corp. 1986 survey of the 8-1/2 square mile area
- Includes estimate of Everglades Agricultural Area subsidence
- Other data as in SFWMM v3.7
- FWC survey 1992 for the Holey Land Wildlife Management Area.

Descriptions, Features and Assumptions of Model Runs

September 2003 update includes:

- Reverting to FWC 1992 survey data for Rotenberger Wildlife Management Area.
- DHI gridded data from Kimley –Horn contracted survey of EAA, 2002-2003. Regrided to 2x2 scale for EAA outside of STAs and WMAs.

Sea Level

- Sea level data from six long-term NOAA stations were used to generate a historic record to use as sea level boundary conditions for the 1965 to 2000 evaluation period.

Land Use

- All land use has been updated using most recent FLUCCS data (1995), modified in the Lower East Coast urban areas using 2000 aerial photography (2x2 scale).

(Documented in August 2003 SFWMD memorandum from J. Barnes and K. Tarboton to J. Obeysekera).

Natural Area Land Cover (Vegetation)

Vegetation classes and their spatial distribution in the natural areas comes from the following data:

- Walsh 1995 aerial photography in Everglades National Park
- Rutchey 1995 classification in WCA-3B, WCA-3A north of Alligator Alley and the Miami Canal, WCA-2A & 2B
- Richardson 1990 data for Loxahatchee National Wildlife Refuge
- FLUCCS 1995 for Big Cypress National Preserve, Holey Land & Rotenberger Wildlife Management Areas & WCA-3A south of Alligator Alley and the Miami Canal.

(Documented in August 2003 SFWMD memorandum from J. Barnes and K. Tarboton to J. Obeysekera).

Lake Okeechobee Service Area

LOSA Basins

- Lower Istokpoga, S-4, North Lake Shore and Northeast Lake Shore demands and runoff based on AFSIRS modeling.

Lake Okeechobee

- Lake Okeechobee Regulation Schedule WSE according to WSE decision trees.

Descriptions, Features and Assumptions of Model Runs

- Lake Okeechobee Supply Side management policy for Lake Okeechobee Service Area water restriction cutbacks as per rule 40E-21 and 40E-22 (13.5 – 11.0 ft. trigger line). A 67% maximum cutback will be implemented.
- Emergency flood control backpumping to Lake Okeechobee from the Everglades Agricultural Area.
- Kissimmee River inflows based on interim schedule for Kissimmee Chain of Lakes using the UKISS model.
- Best Management Practices runoff reduction assumed to be 0%. BMP Makeup water (Replacement Water Rule) target has an average of 102 KAF per year for the 36-yr period. Actual deliveries can be less due to conveyance limitations, WCAs above schedule and suspension of makeup water deliveries due to SSM.

Caloosahatchee River Basin

- Caloosahatchee River Basin irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage.
- Public water supply daily intake from the river is included in the analysis.

St. Lucie Canal Basin

- St. Lucie Canal Basin demands estimated using the AFSIRS method based on existing planted acreage.
- Basin demands include the Florida Power & Light reservoir at Indiantown.

Seminole Brighton Reservation

- Brighton Reservation demands were estimated using the AFSIRS method based on existing planted acreage.
- Demands are in agreement with the entitlement quantities as per Table 7, Agreement 41-21 (Nov 92).
- Supply-side management applies to this agreement.

Seminole Big Cypress Reservation

- Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage.
- The 1 in 5 demand is in agreement with the Seminole Compact (Work Plan = 2606 MGM, Model = 2659 MGM) .
- Supply-side management applies to the Compact.

Everglades Agricultural Area

- Everglades Agricultural Area irrigation demands are simulated using climatic data for the 36 year period of record and a soil moisture accounting algorithm, with parameters calibrated to match historical regional supplemental deliveries from Lake Okeechobee.

Descriptions, Features and Assumptions of Model Runs

- Best Management Practices assumed to reduce runoff 0% annually.

Everglades Construction Project Stormwater Treatment Areas

- Stormwater Treatment Areas 1W, 5 & 6 operational.
- Stormwater Treatment Area 2 complete but not connected to the regional system.
- Operation of Stormwater Treatment Areas assumes 6" minimum depth during periods of drought.

Holey Land Wildlife Management Area

- As per Memorandum of Agreement between the FWC and the District.

Rotenberger Wildlife Management Area

- Interim Operational Schedule as defined in the Operation Plan for Rotenberger (SFWMD Jan 2001).

Water Conservation Areas

Water Conservation Area 1 (ARM Loxahatchee National Wildlife Refuge)

- Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals.
- No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft.
- The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow from Lake Okeechobee.

Water Conservation Area 2 A&B

- Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals.
- No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow from Lake Okeechobee.

Water Conservation Area 3 A&B

- Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals.
- No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow from Lake Okeechobee.

Lower East Coast Service Areas

Public Water Supply and Irrigation

- Public water supply wellfield pumpages and locations are based on actual pumpage data for calendar year 2000 (includes Miami-Dade County Water and Sewer Department West Wellfield Aquifer Storage and Recovery system).
- Irrigation demands are based upon existing land use and calculated using AFSIRS, reduced to account for landscape and golf course areas irrigated using reuse water and landscape areas irrigated using public water supply.

Seminole Hollywood Reservation

- Hollywood Reservation demands are set forth under VI.C of the Water Rights Compact.

Natural Areas

- For the Northwest Fork of the Loxahatchee River, the District operates the G-92 structure and associated structures to provide approximately 50 cfs over Lainhart Dam to the Northwest Fork, when the District determines that water supplies are available.
- Flows to Pond Apple Slough through S-13A are adjusted in the model to approximate measured flows at the structure.
- Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay.

Canal Operations

- C&SF system and operating rules in effect in 2000.
- Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion.
- Includes existing secondary drainage/water supply system.
- Excludes portions of the South Dade Conveyance System that follow rules for Test 7 Phase 1 water deliveries to Everglades National Park, as per Restudy 1995 Existing Condition.

Western Basins and Big Cypress National Preserve

Western Basins

- Estimated and updated historical inflows from western basins at two locations: G-136 and G-406. The G-406 location represents potential inflow from the C-139 Basin into STA 5. Data for the period 1978 - 2000 is the same as the data used for the C-139 Basin Rule development.

Descriptions, Features and Assumptions of Model Runs

(Documented in June 2002 SFWMD memorandum from L. Cadavid and L. Brion to J. Obeysekera).

Big Cypress

- The northern end of Big Cypress receives flows from S-190.
- Tamiami Trail culverts are not modeled in SFWMM due to the coarse (2x2 mile) model resolution.

Everglades National Park and Florida Bay

Everglades National Park

- Water deliveries to Everglades National Park are based on Test 7 Phase 1 as per Restudy 1995 Existing Condition.

Region-wide Water Management and Related Operations

Water Management Rules

- The existing condition reflects the existing water shortage policies in 2000 as reflected in South Florida Water Management District rule 40E-21.
- The impacts of declarations of water shortages on utility water use reflect assumpti

Model Run Name : 2050B1 - CERP Future Without Project (2050) Condition

Description

The 2050B1 future without project condition represents predicted conditions that will exist in South Florida in 2050, without the implementation of CERP projects. In general assumptions in the 2050B1 represent structures, operations, system demands and land use that are projected to be in place in the year 2050. The 2050 future without project condition is used for planning purposes, and since planning by nature is iterative the simulation is labeled 2050B1, with the expectation that it will be updated as assumptions change over time. It is the 2050 future without project condition that we use in planning to measure the benefits of the implementation of CERP.

Link to the 2050 future without project condition assumptions table:

http://pmviewer.cerpzone.org/cerp_recover/showDocument.do?documentID=153

Feature Assumptions

Regional Input Data

Climate

- The climatic period of record is from 1965 to 2000.
- Rainfall estimates have been revised and updated for 1965-2000.
- Revised evapotranspiration methods have been used for 1965-2000.

These data are the same as the existing condition.

Topography

Updated November 2001 and September 2003 using latest available information (in NGVD 29 datum). This update incorporates the Nov 2001 update (Documented in November 2001 SFWMD memorandum from M. Hinton to K. Tarboton) includes:

- USGS High Accuracy Elevation data from helicopter surveys collected 1999-2000 for Everglades National Park and Water Conservation Area (WCA) 3 south of Alligator Alley.
- USGS Lidar data (May 1999) for WCA-3A north of Alligator Alley
- Lindahl, Browning, Ferrari & Helstrom 1999 survey for Rotenberger Wildlife Management Area (WMA).
- Stormwater Treatment Area (STA) surveys from 1990s

Descriptions, Features and Assumptions of Model Runs

- Aerometric Corp. 1986 survey of the 8.5 square mile area
- Includes estimate of Everglades Agricultural Area (EAA) subsidence
- Other data as in SFWMM v3.7
- FWC survey 1992 for the Holey Land Wildlife Management Area.

September 2003 update includes

- Reverting to FWC 1992 survey data for Rotenberger Wildlife Management Area.
- DHI gridded data from Kimley –Horn contracted survey of EAA, 2002-2003. Regrided to 2x2 scale for EAA outside of STAs and WMAs.

These data are the same as the existing condition. No subsidence will be addressed; subsidence in the EAA and other areas may be addressed in the next CERP Update.

Sea Level

- Sea level data from six long-term NOAA stations were used to generate a historic record to use as sea level boundary conditions for the 1965 to 2000 evaluation period.
- A sensitivity analysis will be performed utilizing an 0.8 foot rise in sea level so that the impacts of such a change on the performance of the water management system can be assessed.

Land Use

- Lands not developed in the existing condition are assigned land use codes crosswalked from county comprehensive plans (future land use).

Natural Area

Vegetation classes and their spatial distribution in the natural areas comes from the following data:

- Walsh 1995 aerial photography in Everglades National Park
- Rutchey 1995 classification in WCA-3B, WCA-3A north of Alligator Alley and the Miami Canal, WCA-2A & 2B
- Richardson 1990 data for Loxahatchee National Wildlife Refuge
- FLUCCS 1995 for Big Cypress National Preserve, Holey Land & Rotenberger Wildlife Management Areas & WCA-3A south of Alligator Alley and the Miami Canal. (Documented in August 2003 SFWMD memorandum from J. Barnes and K. Tarboton to J. Obeysekera).

These data are the same as in the existing condition.

Descriptions, Features and Assumptions of Model Runs

Lake Okeechobee Service Area

LOSA Basins

- Lower Istokpoga, S-4, North Lake Shore and Northeast Lake Shore demands and runoff are based on AFSIRS modeling using 2050 land use projections.

Lake Okeechobee

- Lake Okeechobee Regulation Schedule WSE according to WSE decision trees.
- Lake Okeechobee Supply Side Management policy for Lake Okeechobee Service Area water restriction cutbacks as per rule 40E-21 and 40E-22 (as amended in September, 2001) (13.0 – 10.5 ft. SSM trigger line). .
- Adaptive Protocols are included.
- Kissimmee River Restoration and Headwaters Revitalization Project is complete.
- Average annual environmental deliveries to the WCAs equal the annual average Best Management Practices (BMP) Replacement Water Rule volumes (102 ,000 ac-ft/year).
- BMP runoff reduction is assumed to be 0%; there are no makeup water deliveries.

Caloosahatchee River Basin

- • Caloosahatchee River Basin irrigation demands and runoff were estimated using the AFSIRS method based on projected acreage as per the 2000 Caloosahatchee Water Management Plan projections for 2020.
- • Public water supply daily intake from the river is ~10 MGD.

St. Lucie Canal Basin

- • St. Lucie Canal Basin demands were based on the Indian River Lagoon draft feasibility study future without project condition projected acreages for 2050.
- • Basin demands include the Florida Power & Light reservoir at Indiantown.

Seminole Brighton Reservation

- • Brighton Reservation demands were estimated using the AFSIRS method based on existing planted acreage.

Descriptions, Features and Assumptions of Model Runs

- • Demands are in agreement with the entitlement quantities as per Table 7, Agreement 41-21 (Nov 92).
- • Supply-side management applies to this agreement.

Seminole Big • Big Cypress Reservation

- irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage.
- • Demands are in agreement with the Seminole Compact.
- • Supply-side management applies to the Compact.

Everglades Agricultural Area

- • Everglades Agricultural Area irrigation demands are simulated using climatic data for the 36 year period of record and a soil moisture accounting algorithm, with parameters calibrated to match historical regional supplemental deliveries from Lake Okeechobee.
- • BMPs are assumed to reduce runoff 0% annually.
- • Demands reflect the construction of STA 3/4.

Everglades Construction Project Stormwater Treatment Areas

- • All Stormwater Treatment Areas are maintained at a 6" minimum depth during periods of drought.
- • As compared to the existing condition:
 - STA-2 is connected to the regional system
 - STA 3/4 and STA 1E are constructed and operational
 - STA-6 area increased from 870 to 2421 acres due to Phase 2 construction.

Holey Land Wildlife Management Area

- • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000).

Rotenberger Wildlife Management Area

- • Interim Operational Schedule as defined in the Operation Plan for Rotenberger (SFWMD July 2002).

Water Conservation Areas

Descriptions, Features and Assumptions of Model Runs

Water Conservation Area 1 (ARM Loxahatchee National Wildlife Refuge)

- • Current C&SF Regulation Schedule. Includes regulatory releases to tide through lower east coast (LEC) canals.
- • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. and reads: "No net releases from WCA-1. Any water supply releases below the floor will be matched by an equivalent volume of inflow from Lake Okeechobee."
- • Operations are the same as the existing condition.

Water Conservation Area 2 A&B

- • Rainfall driven operational criteria for determining timing of deliveries to and discharges from WCA-2A.

Water Conservation Area 3 A&B

- • Rainfall driven operational criteria for determining timing of deliveries to and discharges from WCA-3A.
- • Structural and operational modifications for L-67 canal conveyance and S-355 structures as in the federally authorized Modified Water Delivery Project. Refer to separate Modified Water Deliveries (MWD), 8.5 square mile area, and C-111 table for details.

Lower East Coast Service Areas

Public Water Supply and Irrigation

- • Projections are based upon IWR MAIN methodologies (September 2003 final report). The focus will be on changes in population / economic projections and water conservation effectiveness.
- • Projections take into account a 15% across the board increase in demand to account for alternative treatment technologies.
- • Wellfield distribution as in the LECRWSP for 2020 (LEC1).
- • Irrigation demands are based on projected land use and calculated in the same manner as the existing condition.
- • Miami-Dade aquifer storage and recovery (ASR) West Wellfield is 15 MGD, Northwest and Southwest Wellfields are 10 MGD each.
- • Wastewater reuse has been incorporated in the estimation of landscape irrigation demands for each county.

Descriptions, Features and Assumptions of Model Runs

Seminole Hollywood Reservation

- • Hollywood Reservation demands are set forth under VI.C of the Water Rights Compact.

Natural Areas

- • For the Northwest Fork of the Loxahatchee River, the District operates the G-92 structure and associated structures to provide approximately 50 cfs over Lainhart Dam to the Northwest Fork, when the District determines that water supplies are available.
- • Flows to Pond Apple Slough through S-13A are adjusted in the model to approximate measured flows at the structure.
- • Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay.

These data are the same as the existing condition.

Canal Operations

- • C-11 Water Quality Treatment Critical Project constructed (S-381 Ogee Gated Spillway and Pumping Station S-9A).
- • Western C-4 Structure (S-380) Critical Project constructed.
- • C-4 Flood Mitigation Project includes 440 and 434 +/- acre impoundments to store stormwater from the C-4 Basin.
- • Recently completed S-25B and S-26 pumps will not be modeled since they would be used very rarely during high tide conditions and the SFWMM uses a long-term average daily tidal boundary.
- • Operational adjustments to maintain water levels in the coastal canals to meet minimum levels in the Biscayne Aquifer as proposed in the LECRWSP.
- • Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry.
- • Eastern Hillsboro Utility ASR is 5 MGD.
- • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are no longer sent into the Loxahatchee National Wildlife Refuge, but instead to C-51 East through the S-155A structure.

Western Basins and Big Cypress National Preserve

Western Basins

Descriptions, Features and Assumptions of Model Runs

- • Estimated and updated historical inflows from western basins at two locations: G- 136 and G-406. The G-406 location represents potential inflow from the C-139 Basin into STA 5. Data for the period 1978 - 2000 is the same as the data used for the C-139 Basin Rule development.

(Documented in June 2002 SFWMD memorandum from L. Cadavid and L. Brion to J. Obeysekera). Data are the same as the existing condition.

Big Cypress

- • The northern end of Big Cypress receives flows from S-190.
- • No Tamiami Trail culverts are modeled in the SFWMM due to the coarse (2x2 mile) model resolution.

Everglades National Park and Florida Bay

- • Structural and operational modifications for L-67 extension canal as in the federally authorized Modified Water Delivery Project.
- • 8.5 SMA as per the federally authorized Alternative 6D of the 8.5 SMA project.
- • C-111 project features and operations as per Restudy 2050 Base.

Refer to separate MWD, 8.5.SMA, C-111 table for details.

Region-wide Water Management and Related Operations

- • The future without project condition reflects the existing water shortage policies in 2000 as reflected in South Florida Water Management District rule 40E-21.
- • The impacts of declarations of water shortages on utility water use reflect assumptions contained in the LECRWSP.

These data are the same as in the existing condition.

Model Run Name : CERP1

Description :

CERP1 is a simulation of the "with project" condition which incorporates new information into modeling of the CERP with the latest version of the South Florida Water Management Model (SFWMMv5.4). An alternative "with project" simulation named [CERP0](#) has also been posted.

The major differences between the two alternative "with project" simulations are:

- **CERP1** uses updated public water supply demands in the LEC (as in the 2050 future without project condition) and updated agricultural water supply demands in the Caloosahatchee Basin (also in the 2050 future without) but limits average annual water supply deliveries from Lake Okeechobee to the Caloosahatchee Basin to be the same as annual average D13R volumes (consistent with the Caloosahatchee Water Management Plan and Lower East Coast Regional Water Supply Plan).
- **CERP0** uses D13R public water supply demands in the LEC and "D13R-like" demands in the Caloosahatchee (C-43) Basin.

Modeling specification differences between CERP0 & CERP1 and D13R were arrived at through discussion with RECOVER project leaders and the Interagency Modeling Center, CERP1 Modeling Team.

Comparison of Various CERP Model Runs

The Initial CERP Update (ICU) is being undertaken by the interagency, interdisciplinary RECOVER Team. One purpose of the update is to incorporate new information into the planning process that has been gained since the C&SF Comprehensive Review Study was completed in July 1999. A second purpose is to simulate the Comprehensive Everglades Restoration Plan (CERP) using the latest versions of the South Florida Water Management Model (SFWMM) and the Natural System Model (NSM). A set of principles was provided by RECOVER project leaders to guide the simulation of the Comprehensive Plan with the new data and updated tools. Those principles were:

- to use 2050 future without project assumptions for all non-CERP components (as documented in the 2050 future without project condition, see link below)
- for all CERP projects, use project definitions as defined in C&SF Project Comprehensive Review Study (July 1999, aka the "Yellow Book") and modeled in D13R (Nov. 98 version) , i.e., do not make changes to the Plan
- seek guidance from RECOVER project leaders should differences between project definitions and modeled project assumptions occur

Descriptions, Features and Assumptions of Model Runs

Two model simulations for the Initial CERP Update have previously been completed – a simulation of the 2000 existing condition and the 2050 without project condition. Two additional model simulations have now been completed and are being presented for review and evaluation by RECOVER’s Regional Evaluation Team (RET) and the ICU Team. The nomenclature on the performance measure graphics for these two additional simulations is “CERP0” and “CERP1”. CERP0 & CERP1 are simulations of the “with project” condition that incorporate new information into modeling of the CERP with the latest version of the SFWMM (version 5.4). Differences between CERP0 & CERP1 are:

- CERP0 uses D13R public water supply demands in the Lower East Coast and “D13R-like” demands in the Caloosahatchee (C-43) Basin
- CERP1 uses updated public water supply demands in the Lower East Coast (as in the 2050 future without project condition) and updated agricultural water supply demands in the Caloosahatchee Basin (also in the 2050 future without) but limits average annual water supply deliveries from lake Okeechobee to the Caloosahatchee Basin to be the same as annual average D13R volumes (consistent with the Caloosahatchee Water Management Plan and Lower East Coast Regional Water Supply Plan)

Modeling specification differences between CERP0 & CERP1 and D13R

All modeling specification differences between CERP0 & CERP1 and D13R were arrived at through discussion with RECOVER project leaders and the Interagency Modeling Center, CERP1 Modeling Team. Modeling specifications not listed here are consistent with those specified for D13R in the Yellow Book. Some of the differences below are non-CERP project changes (e.g., implementation of the WSE schedule for Lake Okeechobee), and are listed separately.

Modeling specification differences in CERP

Lake Okeechobee operations

- ASR injection at the bottom of Zone D of WSE (CERP0 & CERP1 injection begins ~ ½’ lower than D13R, hence puts water into ASR sooner); becomes highest priority for injection
- ASR recovery follows new SSM line + ¼’ and is ~ 1’ lower than D13R
- Injection for North of Lake Storage and EAA Reservoir now second in priority; CERP0 & CERP1 injection ~ ¼’ higher than D13R; shape of line is parallel to Zone D of WSE
- North of Lake Storage seepage losses assumed to be 50% in CERP0 & CERP1 (consistent with LECRWSP) compared to 100% in D13R

Other operational adjustments

Descriptions, Features and Assumptions of Model Runs

- Shift in STA 3-4 discharge priorities for hydropattern enhancement
- Flows allowed to Pond Apple Slough
- NSM stage targets based on NSMv4.6.2 ponding depths and adjusted due to changes in topo; D13R used NSMv4.5 ponding depths
- L-67 weir heights adjusted due to changes in topo to enhance flows to ENP

Public water supply

- CERP1 includes a 15% conservation assumption compared to the D13R assumption of 12%; D13R component AAA LEC Utility Water Conservation (6%) is not included in CERP1
- CERP1 wellfield locations are the same as D13R with demands higher in some wellfields (based on data from Gulf Engineering M&I Report and bulk sales) and lower in others (use of alternative sources, bulk purchasers)

Modeling specification differences for non-CERP projects (also included in 2050 future without project condition)

Lake Okeechobee operations

- WSE operation schedule for CERP0 & CERP1; D13R used Run 25

Caloosahatchee and St. Lucie basins

- Revised time series hydrologic data created revised demands and runoff and targets for environmental deliveries to the estuaries

Other operational adjustments

- BMP runoff reduction from the EAA calculated to be 0% in CERP0 & CERP1; D13R had 18% runoff reduction
- STAs to maintain 6" min depth in times of mild to moderate drought

Public water supply

- Includes updated M&I demand projections for the Lower East Coast based on Gulf Engineering M&I Report

Inclusion of additional utility ASR changes seasonality of wellfield withdrawals

- Raw water withdrawals by utility increased by 15% to account for anticipated conversion to advanced treatment technologies with reject water lost to system due to current unpermittability for reuse (canal recharge)

Model Run Name : NSM4.6.2

Description

The Natural System Model (NSM) simulates the hydrologic response of an Everglades watershed in its pre-drainage condition. Recent climatic data is used to simulate the pre-drainage hydrologic response to current hydrologic input allowing for meaningful comparisons between SFWMM simulations and NSM simulations. Vegetation, topography, and river courses used by the NSM are based on pre-drainage conditions.

NSM Version 4.6.2 uses the same climatic input, computational methods, and model parameters calibrated and verified by the SFWMMv5.4 (e.g. ET, Manning's "n") including:

- updated tidal boundary stations
- new rainfall based on "10-tin" interpolation
- reformulated PET dataset
- modified landscape coverage
- updated soil storage coefficients
- updated et and manning's coefficients
- revised topography
- updated inflow boundary flows into Lake Okeechobee and Lake Istokpoga (dbhydro changes)
- expanded period of record through 2000

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Joel,

The 2X2 runs coupled to FATHOM model (shown in MFL document for Little Madeira Bay) were received for our use on May 5, 2005. They are referenced by Danielle Lyons in an August 2004 email as :**2000B2, 2050B2, and CERP1**. NSM was not referenced.

The runs coupled with the Taylor River Model were received by Frank Marshall August 25, 2004 and (used for RECOVER modeling work). They are referenced by Xu Hong in an August 26,2004 email as: **2000CERP and 2050CERP**. Also referenced by Frank Marshall in that exchange were CERP1 and NSM4.6.2.

Features of some of these runs are summarized in the table below.

EXISTING CONDITIONS	FUTURE WITHOUT PROJECT CONDITIONS	FUTURE WITH PROJECT CONDITIONS
<p>2000B1 (SFWMM 5.0)</p> <p>The 2000B1 Existing condition represents conditions that existed in South Florida in 2000, when CERP was approved. In general, assumptions in the 2000B1 represent structures, operations, system demands and land use that were in place in the year 2000. Where emergency operations were in place at that time, operations more representative of "normal" operations have been used in the 2000 existing condition for long-term simulation. The 2000 existing condition is a planning base, and since planning by nature is iterative the simulation is labeled 2000B1, with the expectation that it will be updated as assumptions change over time through the review process.</p>	<p>2050B1 (SFWMM 5.0) (rainfall driven ops)</p> <p>The 2050 future without project condition represents predicted conditions that will exist in South Florida in 2050, without the implementation of CERP projects. In general, assumptions in the 2050 represent structures, operations, and land use projected to be in place in the year 2050.</p>	<p>D13R (SFWMM 3.5.7)</p> <p>Describes conditions that are expected to exist in 2050 if the Comprehensive Everglades Restoration Plan (CERP) is implemented subject to 1965-1995 climatic conditions. Alternative D13R is the plan selected by the full Restudy Team as the initial draft plan. The components contained in Alternative D13R are derived from components which were developed in earlier Alternatives. Some components have been modified from their original design in order to meet the environmental objectives of restoration of historic sheetflow and ecological connectivity.</p>
<p>2000B2 (SFWMM 5.4)</p> <p>The 2000B2 Existing condition simulation is an improved version of the previously posted 2000B1. The 2000B2 inherits most of the assumptions, data and properties from the 2000B1. Modifications to the 2000B1 were made following RECOVER review and other minor changes to be consistent</p>	<p>2050B2 (SFWMM 5.4) (rainfall driven ops)</p> <p>The 2050B2 Future without project condition simulation is an improved version of the previously posted 2050B1. The 2050B2 inherits most of the assumptions, data and properties from the 2050B1. Modifications to the 2050B1 were made following</p>	<p>CERP1 (SFWMM 5.0)</p> <p>CERP1 is a simulation of the "with project" condition which incorporates new information into modeling of the CERP with the latest version of the South Florida Water Management Model (SFWMMv5.4). CERP1 uses updated public water supply demands in the LEC (as in the 2050 future without project condition) and updated agricultural</p>

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EXISTING CONDITIONS	FUTURE WITHOUT PROJECT CONDITIONS	FUTURE WITH PROJECT CONDITIONS
with the new version of the SFWMM (v5.4).	RECOVER review and other minor changes to be consistent with the new version of the SFWMM (v5.4).	water supply demands in the Caloosahatchee Basin (also in the 2050 future without) but limits average annual water supply deliveries from Lake Okeechobee to the Caloosahatchee Basin to be the same as annual average D13R volumes (consistent with the Caloosahatchee Water Management Plan and Lower East Coast Regional Water Supply Plan).
2000B3 (SFWMM 5.4.3) The 2000B3 existing condition simulation is an improved version of the previously posted 2000B2. The 2000B3 inherits most of the assumptions, data and properties from the 2000B2. Modifications to the 2000B2 were made to be consistent with the new version of the SFWMM (v5.4.3). These changes only affect the way in which structure flows in the Stormwater Treatment Areas are simulated.	2050B0 (SFWMM 5.4) (rainfall driven ops) Public water supply demands are those that were projected during the development of the CERP (the Restudy), as are agricultural demands in the Caloosahatchee River basin.	CERP0 (SFWMM 5.4) CERP0 is a simulation of the "with project" condition which incorporates new information into modeling of the CERP with the latest version of the South Florida Water Management Model (SFWMMv5.4). CERP0 uses D13R public water supply demands in the LEC and "D13R-like" demands in the Caloosahatchee (C-43) Basin.
	2050B3 (SFWMM5.4.3) (NO rainfall driven ops) Public water supply demands are those that were projected during the development of the CERP (the Restudy), as are agricultural demands in the Caloosahatchee River basin.	CERPA (SFWMM 5.4.3) CERPA is the latest simulation of the CERP (D13R), using version 5.4.3 of the SFWMM. CERPA modeling mimics closely the structural and operational intent of D13R, using the new tool. It was adapted from the CERP0 scenario with the following differences: Expanded stormwater treatment areas associated with the Acceler8 Everglades Construction Project configuration (as in the 2050B3) Updated climate forecasts as in 2050B3 Lake Okeechobee operational lines for ASR injection and deliveries to North of Lake Storage and EAA Reservoir the same as in D13R ASR recovery line modified due to changes in the supply side management line Offsets, translations, and truncations to NSM targets use same logic as D13R C-9 reservoir modeled as a physical feature and ACME Basin B project incorporated Updated Caloosahatchee and St.
	50B3S4 (SFWMM5.4.3) (rainfall driven ops) 50B3S4 uses Everglades rainfall driven operations (similar to the previously posted 2050B0 and 2050B2 scenarios) based on NSMS4 targets to operate WCA2A, WCA2B, WCA3A, WCA3B and ENP. Public water supply demands are those that were projected during the development of the CERP (the Restudy), as are agricultural demands in the Caloosahatchee River basin.	

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EXISTING CONDITIONS	FUTURE WITHOUT PROJECT CONDITIONS	FUTURE WITH PROJECT CONDITIONS
		Lucie estuary targets

EFFECTS OF FUTURE RESTORATION PROJECTS ON FRESHWATER FLOW AND SALINITY CONDITIONS

Regional modeling was performed to determine the relative impact of the future CERP projects on the proposed MFL criteria. Using flow input from the South Florida Water Management Model (SFWMM), salinity predictions were produced for Little Madeira Bay using the FATHOM model (Environmental Consulting and Technology, Inc. 2005) and for the Taylor River site using the Taylor River MLR Model (Marshall, 2005). The input data set in each model was extended to 36 years to span 1965 - 2000. Salinity simulations were then produced for each of the following water management scenarios: 2000B (base case 2000 which assumes 2000 operations), 2050 (future with no project), CERP1 (future with CERP project), and NSM 4.6.2 (natural system).

Taylor River Site

The regional modeling salinity predictions using the SFWMM for the Taylor River site (Marshall, 2005) show differences between the 4 scenarios over the 36 year simulations relevant to the proposed MFL (**Figure 5-9**)

Base case (2000B): Significant harm occurred 5 times in the 36 year simulation period. That equates to a return frequency of 1:7 years.

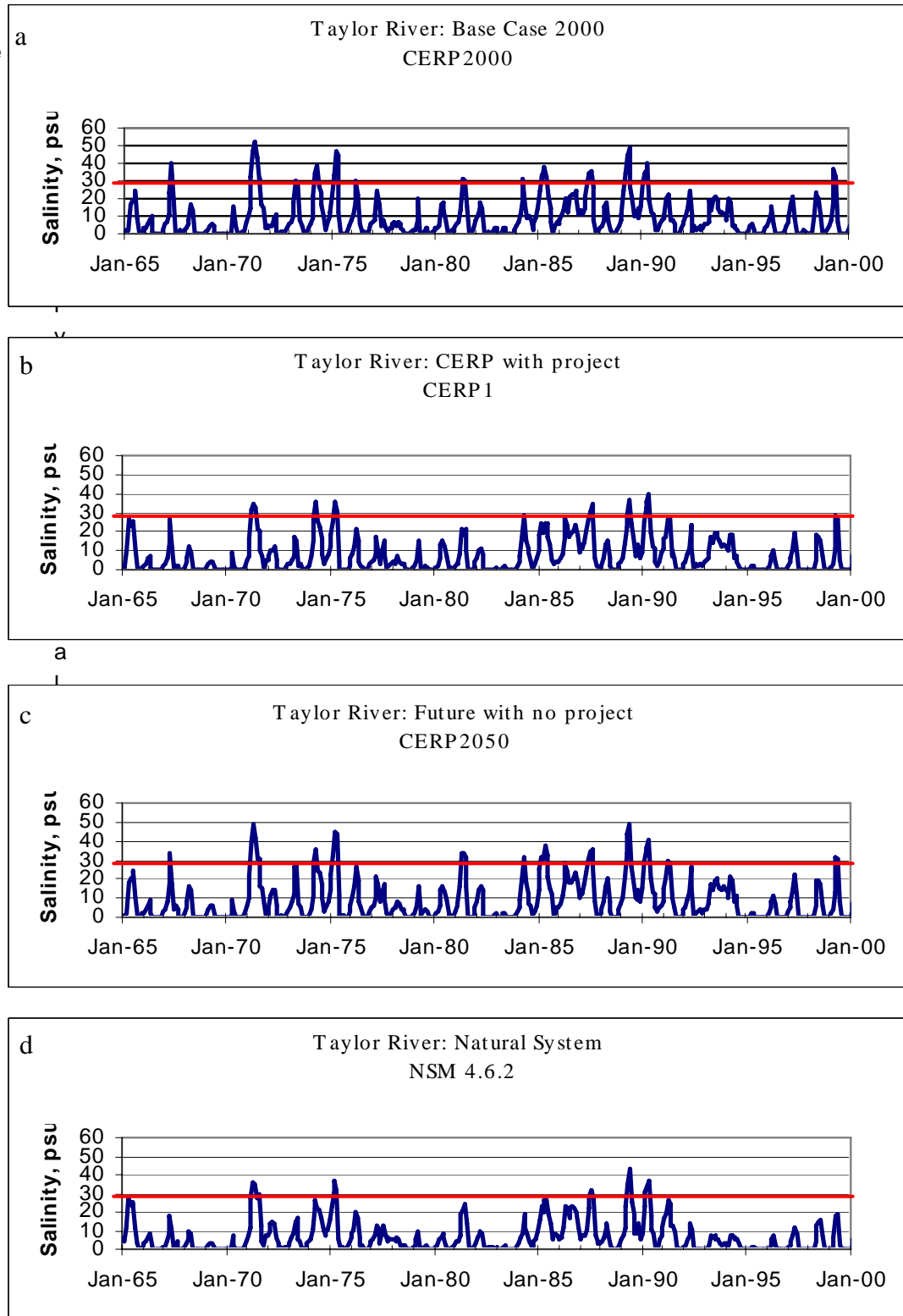
Future with no project (2050): Significant harm occurred 4 times in the 36 year simulation period. That equates to a return frequency of 1: 9 years.

Future with CERP Project (CERP1): Significant harm occurred 2 times in the 36 year simulation period. That equates to a return frequency of 1:18 years.

Natural System (NSM): Significant harm occurred 1 time in the 36 year simulation period. That equates to a return frequency of 1:36 years.

In summary, significant harm in the NSM scenario occurred only during two consecutive drought years for Florida Bay 1989 and 1990. There is no significant difference between the current base case 2000 and the future with no project (2050). The CERP1 scenario predicts an improvement relative to current and future with no project.

Figure



om Marshall 2005) for (a) base case (2000) (b) future no project (2050) (c) future with project (CERP1) (d) natural system (NSM 4.6.2). Markers denote occurrences of significant harm.

Northeastern Florida Bay

Results from the regional modeling scenarios described above were also run with outputs provided for the FATHOM model and salinity throughout Florida Bay was calculated (Environmental Consulting and Technologies, Inc., 2005). A comparison of these results for Little Madeira Bay, with the FATHOM historic base case (**Figure 5-10**), showed that this base case markedly differed from all SFWMM alternatives, but there was little difference among these alternatives. The base case likely differs in the historic predictions (1965 – 1990) because it includes actual operations of a given year (i.e. it is based on empirical conditions), while each SFWMM alternative entails an assumption of constant operations (either given as a recent historic year or as a future plan). As documented in the water budget substantially less inflow was directed to northeast Florida Bay during the historic periods due to water management activities in the watershed (Environmental Consulting and Technology, Inc. 2005). However, this generality does not entirely explain why predictions in recent years for the 2000B (CERP2000), which has similar operations in recent years to the FATHOM historical base case, are lower. Predictions for all SFWMM scenarios for Little Madeira Bay appear to be biased low relative to the FATHOM base case, a calibrated and verified model, shown to provide reasonable salinity predictions in Little Madeira Bay compared to observed data (Environmental Consulting and Technology, Inc. 2005). The Taylor River runs (**Figure 5-9**) have a correction for bias which appear to represent more realistically the historic salinity reconstruction (**Figure 5-1**). A similar bias correction when interfacing FATHOM and SFWMM may be warranted for future comparisons. The drought period of 1989 – 1990 indicates prolonged elevated salinities with all scenarios. The only difference between the input data sets among the SFWMM scenarios is the wetland inflow data. Average annual inflow to the northeast portion of Florida Bay for the NSM scenario (which includes Little Madeira Bay), is 23 % less than the average inflow in the northeast Bay for the 2000B scenario (**Table 5-2**). However, the NSM scenario has higher inflow directed into the central region than the other three scenarios. Average annual inflow for the 2000B scenario is comparable to the average annual inflow for the FATHOM base case, although the timing and relative variation in magnitude of flows is different with the different alternatives.

Table 5-1. Summary of fresh water inflow defined by each of the SFWMM scenarios (from Environmental Consulting Technologies, Inc., 2004) . Units are 1000 acre-feet per year, averaged over the period 1965 through 2000. Summary of the FATHOM base case inflow for the period 1970 through 2000 are provided for reference.

SCENARIO	CENTRAL	NORTHEAST	TOTAL
2000B	30	200	230
2050	31	179	210
CERP1	34	152	186
NSM	61	117	178
FATHOM base (1970-2000)	28	204	232

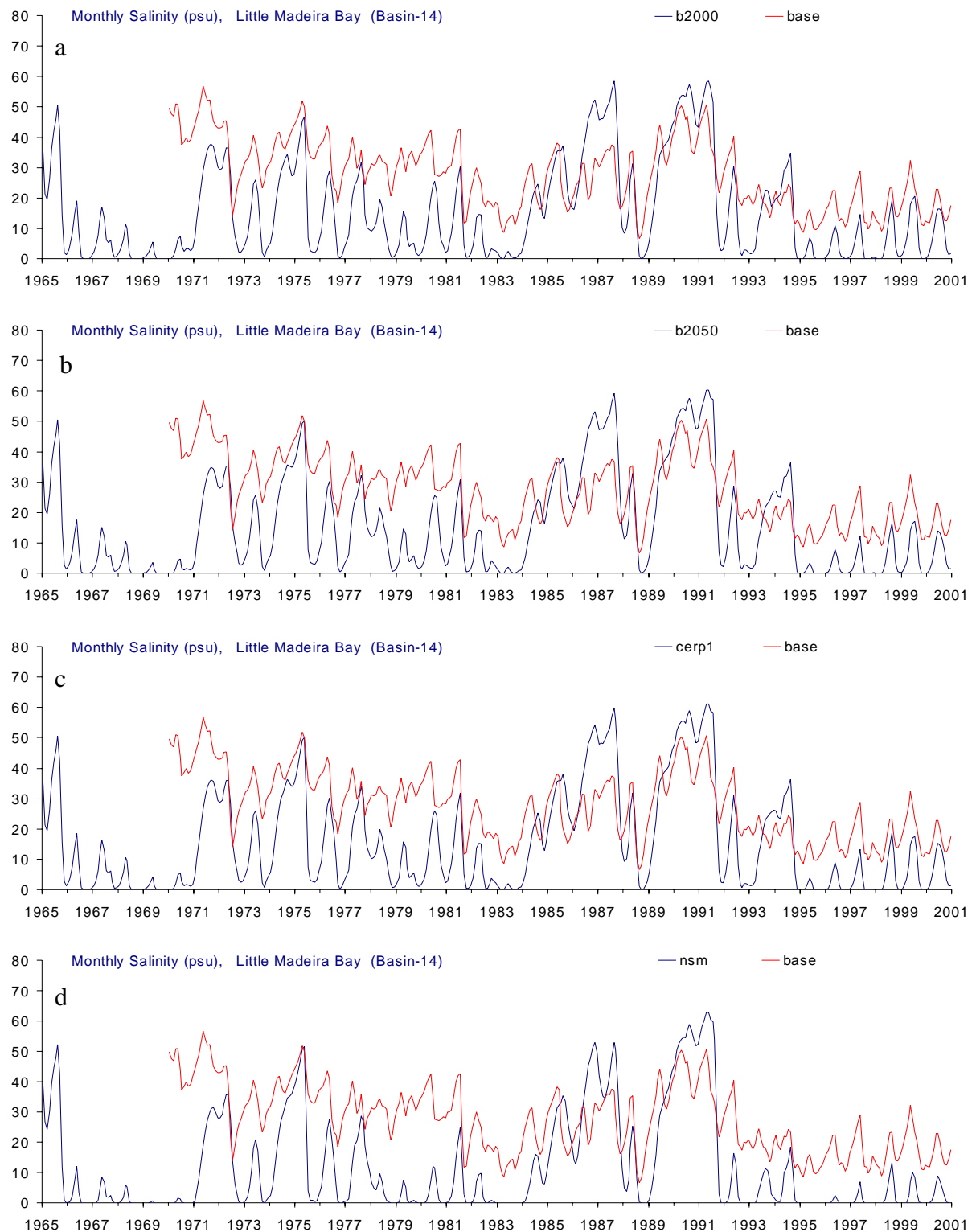


Figure 5-2. Little Madeira regional modeling results for (a) base case (2000) (b) future no project (2050) (c) future with project (CERP1) (d) natural system (NSM 4.6.2). The salinity time series obtained for the FATHOM historical base case is shown on all plots (red lines) for point of reference (ECT, Inc., 2005). There are no discernable differences among alternatives for Little Madeira Bay.